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SCIENTIFIC RESEARCH ON PAPAVER BRACTEATUM [1]

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Identification of Papaver bracteatum and other species of Papaver section Oxytona from leaf epidermis impressions [2]

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1/ General note: The views expressed by collaborating scientists in their contributions to the programme are not necessarily shared by the Secretariat.

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3/ This paper was submitted by Dr. Quentin Jones, Chairman of the Third Working Group on Papaver bracteatum.

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Although section Oxytona of Papaver, to which P. bracteatum is assigned, is itself distinct in the genus, species identification within the section is difficult, and has been up till now possible only from flowering or fruiting material. With the increasing importance of P. bracteatum as a potential crop plant and experimental subject, identification of seedling material is necessary in preventing considerable waste of time and effort in growing unwanted species.

As a result of a taxonomic study supported by the Agricultural Research Service of the United States Department of Agriculture on section Oxytona, which has included cytological data, the systematics of the section is now much better understood. The results of this study (Goldblatt 1974) have indicated the existence of three distinct species in the section, each chemically and cytologically, as well as morphologically, quite distinct. The three species are Papaver orientale L. (2n=28); P. bracteatum Lindl. (2n=14) and P. pseudo-orientale (Fedde) Medw. (2n=42). Of the three, only P. bracteatum contains significant amounts of thebaine, either as the only alkaloid or in combination with small amounts of alpenigenine.

The differences in ploidy level among the three species are primarily what has made their distinction possible from seedling stage onward. The seedlings are in fact also morphologically distinct although not easy to recognize except by a very trained eye, and identification on external morphology of the seedlings is not practical. However, species can be determined not only by direct cytological examination but also by the size of cells in the leaf. The feature most readily observed and measured is the stoma, the pore found in the epidermis of plants and in the leaves of Papaver, only on the lower surface.

Method

To examine the epidermis rapidly a cellophane impression is made of the leaf and examined under a compound microscope. There are several methods for producing epidermal impressions, but the most suitable for Papaver has been that described by Payne (1970). Strips of cellulose acetate film (0.0025-0.005 inches thick) are used, cut into pieces about 2 inches long and wide enough to cover a small, detached portion of leaf. The leaf portion is first placed lower surface uppermost on a

glass slide, flooded with acetone, and then the cellulose acetate strip is placed over the leaf and also moistened with acetone. One end of the film should be secured with Scotch tape to the slide.

Only when the acetone has quite evaporated should the leaf be removed, and the other end of the strip should be taped to the slide, making the resulting impression lie as flat as possible but taking care not to stretch it.

Results

Examination of many plants of numerous wild collections from Iran and Turkey has shown that epidermal cell and stoma size are directly related to chromosome number. Thus, Papaver bracteatum has the smallest cells and stomata while P. pseudo-orientale has the largest. Since the stomata are of a regular shape in contrast to the epidermal cells surrounding them which have very sinuous margins, the stomata are most suitable for measurement and comparison. While there is some variation in size between individual stomata, measurement of ± 25 stomata and averaging the total has invariably resulted in the placing of seedlings in their correct species.

Species	Ploidy	Range & mean stoma length	
P. bracteatum	2n	20-32	26
P. orientale	4n	32-45	36
P. pseudo-orientale	6n	43-60	50

Table 1. Range and mean stoma length in Papaver section Oxytona.

Conclusion

Seedlings of the three species recognized in Papaver section Oxytona differ in their ploidy. Papaver bracteatum is the only diploid. Plants known to belong to this section can accordingly be identified at all stages of their development from seedling onwards either by direct cytological examination and determination of chromosome number or by measurement of the size of epidermal cells, particularly the stomata.

While the determination of chromosome number is relatively easy in Papaver from mitotic root tips, the method is time-consuming and can only readily be done by a skilled cytologist with a well equipped cytological laboratory. Epidermal cells can easily be measured with little more equipment than glass slides, cellulose acetate film, and a compound microscope of any kind with no more than a 40X objective lens.

References

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